

DEPARTMENT OF ZOOLOGY
B N COLLEGE (AUTONOMOUS),
DHUBRI, ASSAM

Name of the Department : **ZOOLOGY**
 Semester : **1st Semester**
 Name of the Paper : **Diversity of Non Chordates**
 Paper Code (Major/Minor) : **ZOO-DSC-141**
 Hours : **45 + 30**
 Lecture : **3**
 Tutorial : **Nil**
 Practical : **1**
 Credit : **4 (T-3, P-1)**
 Full Marks : **(75 + 25) = 100**

(Total Printed Page = 3)

Course Outcome:

- CO 1: The completion of this course would provide the learner an outcome of Factual & Conceptual knowledge of different life forms particularly the Non Chordates on the Earth, and appreciate their diversity.
- CO 2: On completion of the course the learner will Understand and gather the Factual & Conceptual knowledge, Remember, Understand, Apply and Analyse the features Non Chordates including Procedural knowledge of systematic organization of the based on their evolutionary relationships, structural and functional affinities.
- CO. 3 The course will also provide Conceptual knowledge to the students aware about the characteristic morphological, anatomical and adaptive features of diverse animals and will create interest among them to explore the animal diversity in nature.

THEORY			
UNIT	SULLABUS	CLASS HOUR	ALLOTTED MARKS
1	<ul style="list-style-type: none"> General characteristics and basis of classification of Non Chordates General characteristics and Classification up to class: Protista <ul style="list-style-type: none"> ❖ Locomotion and Reproduction in Protista General characteristics and Classification up to class: Porifera <ul style="list-style-type: none"> ❖ Evolution of symmetry and segmentation of Metazoa ❖ Canal system and spicules in sponges General characteristics and Classification up to class: Cnidaria <ul style="list-style-type: none"> ❖ Polymorphism in Cnidaria ❖ Corals and coral reef formation 	15	25

2	<ul style="list-style-type: none"> General characteristics and Classification up to class: Ctenophora General characteristics and Classification up to classes: Platyhelminthes&Nemathelminthes <ul style="list-style-type: none"> ❖ Parasitic adaptations in helminths- <i>Fasciola hepatica</i> and <i>Wuchereria bancrofti</i> General characteristics and Classification up to class: Annelida <ul style="list-style-type: none"> ❖ Evolution of coelom and metamerism ❖ Excretion in Annelida General characteristics and Classification up to class: Arthropoda <ul style="list-style-type: none"> ❖ Vision and respiration in Arthropoda ❖ Evolutionary significance of Onychophora 	15	25
3	<ul style="list-style-type: none"> General characteristics and Classification up to class: Mollusca <ul style="list-style-type: none"> ❖ Torsion and detorsion in Gastropoda ❖ Foot modification in molluscs General characteristics and Classification up to class: Echinodermata <ul style="list-style-type: none"> ❖ Water vascular system of Echinodermata ❖ Different larval forms of Echinodermata General characteristics and Classification up to class: Hemichordata <ul style="list-style-type: none"> ❖ Affinities of Balanoglossus 	15	25

PRACTICAL			
UNIT	SYLLABUS	HOURS	MARKS ALLOTTED
1	Study of the whole mount of Euglena, Amoeba and Paramecium collected from different water sources.	4	3
2	Study of minimum of two representatives (specimen/slide/model) of each phylum of non-chordates.	10	10
3	Study of larval forms of Arthropoda / Echinodermata	4	3
4	Study of Permanent Slides: T.S. through pharynx, gizzard and typhlosolar intestine of earthworm.	4	2
5	Study of Permanent Slides: T.S. of Miracidium, Sporocyst and Cercaria Larvae of Liver Fluke.	4	2

6	To submit a Project Report on life cycle of Honey Bee/Wasps/Butterfly/Moth/Mosquito	4	5
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Reference Book:

1. Kotpal, Agarwal and Khetrapal: Modern Textbook of Zoology: Invertebrate, (1976, Rastogi)
2. Marshall: Parker and Haswell Textbook of Zoology, Vol. I (7th ed. 1972, Macmillan)
3. Nigam: Biology of Non-chordates (1985, S. Chand)
4. Jordan and Verma: Invertebrate Zoology (1995, S. Chand)
5. V.K. Agarwal: Diversity of Non-Chordates (1st Ed. 2024, S. Chand And Company Limited)
6. Azad Ali: Diversity of Non-Chordates with Practicals (2023, Kalyani Publishers)
7. Rita Mahanta& I.K. Bhattacharyya: College Zoology (1st Ed. 2004, Reprint 2008), Kalyani Publication
8. Barnes: Invertebrate Zoology (4th ed. 1980, Holt-Saunders)
9. Barnes: The invertebrate (3rd ed. 2001, Blackwell)
10. Barrington: Invertebrate Structure and Function (1967, Nelson)
11. Moore: An introduction to the invertebrates (2001, Cambridge)
12. Ekambaranath Ayar: A manual of Zoology, Part I – Invertebrata, (1973, S. Vishwanathan)

Name of the Department: ZOOLOGY
Semester: B.Sc. 1st Semester
Name of the Paper: Fundamentals of Apiculture
Paper Code: ZOO-SEC-131
Hours: 30+30=60
Lecture: 2,
Tutorial: Nil,
Practical: 1
Credit: 3 (T-2, P-1)
Full Marks: (50+25) = 75

Course Outcome:

Upon completion of the course, students will be able to –

CO 1: Gather factual and conceptual knowledge of ancient history of beekeeping and modern apiculture.

CO 2: Remember, understand, apply and analyse the biology and rearing methods including tools & techniques of honey bee studies.

CO 3: Understand the life cycle and, social organisation of honey bees.

CO 4: Acquire practical knowledge and skill to identify the various stages of honey bees, structure of bee hives along with the knowledge of bee diseases and enemies with their symptoms and control measures.

CO 5: Provide conceptual knowledge on bee economy and various honeybee entrepreneurship opportunities.

THEORY:

Unit No.	Syllabus	Class Hour	Allotted Marks
1.	Introduction to Beekeeping (Apiculture): Definition, History of beekeeping with special reference to India.	2	2
2.	Types of different honeybee species, their Characters and classification.	3	3
3.	Life cycle of Honey Bee.	2	5
4.	Social organization of honeybee colony.	3	7
5.	Rearing of Bees and Modern bee keeping techniques: Artificial Bee rearing (Apiary), Beehives–Newton and Langstroth, Bee Pasturage, Selection of Bee Species for Apiculture, Bee Keeping Equipment, Methods of Extraction of Honey (Indigenous and Modern).	10	20

6.	Bee Diseases and Enemies with their Symptoms, Control and Preventive measures.	5	7
7.	Bee Economy and Entrepreneurship.	5	6

PRACTICAL:

Unit No.	Syllabus	Class Hour	Allotted Marks
1.	Study on the life stages of Honey bees.	7	5
2.	Study on the Modern bee keeping techniques and hives.	5	5
3.	Field visit to understand “Application of modern apiary in agricultural/horticultural field”	10	10
4.	Hands on training on Modern Beekeeping Techniques by experts.	8	5

Reference Books:

- Prost, P. J. (1962): Apiculture. Oxford and IBH, New Delhi.
- Bisht, D.S.: Apiculture, ICAR Publication.
- Singh, S.: Beekeeping in India, Indian council of Agricultural Research, New Delhi.
- Ali, A. (2023): Fundamentals of Apiculture, Kalyani Publishers, New Delhi.

Name of the Department	:	ZOOLOGY
Semester	:	2 nd Semester
Name of the Paper	:	Diversity of Chordates
Paper Code (Major/Minor)	:	ZOO-DSC-142
Hours	:	45 + 30
Lecture	:	3
Tutorial	:	Nil
Practical	:	1
Credit	:	4 (T-3, P-1)
Full Marks	:	(75 + 25) = 100

(Total Printed Page = 4)

Course outcome:

Upon completion of the course, the students will be able to:

CO1: To **remember** about the diversity in animals making students **understand** and conceptualize about their distinguishing features.

CO2: To **remember** about different Zoogeographical realms to **understand** and conceptualize the distribution of different vertebrates in these.

CO3: To **understand** and conceptualize different classes of chordates, level of organization and evolutionary relationship between different subphyla and classes, within and outside the phylum.

CO4: To **understand** and conceptualize about the habit and habitat of chordates in marine, freshwater and terrestrial ecosystems.

CO5: To **Analyze** similarities and differences in life functions among various groups of animals in Phylum Chordata for **application** in taxonomic purpose.

CO6: To **evaluate** the distinction between Poisonous and Non Poisonous Snakes to **create** awareness and knowledge to cope up snake biting issues in society.

Main Syllabus:

Unit No.	Syllabus	Class Hour	Allotted Marks
Unit 1	Introduction to Chordates General characteristics and outline classification .	2 hrs	3
Unit 2	Protochordata General characteristics of Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata .	6 hrs	10
Unit 3	Origin of Chordata Dipleurula concept and the Echinoderm theory of origin of chordates, General Characteristics, Chordates versus Vertebrates.	3 hrs	5
Unit 4	Agnatha General characteristics and classification of cyclostomes up to Class.	2 hrs	3

Unit 5	Pisces General characteristics of Chondrichthyes and Osteichthyes, Classification up to order, Migration, Osmoregulation and Swim bladder in Fish .	6 hrs	10
Unit 6	Amphibia General characteristics and classification up to order; Respiration and Parental care in Amphibians .	4 hrs	7
Unit 7	Reptilia General characteristics and classification up to order; Affinities of Sphenodon; Difference between Poisonous and Non Poisonous Snakes, Poison apparatus and biting mechanism in snakes.	6 hrs	10
Unit 8	Aves General characteristics and classification up to order; Archaeopteryx- a connecting link; Different forms of beak and feet in birds, Flight adaptations and migration in birds.	6 hrs	10
Unit 9	Mammals General characters and classification up to order; Introduction and affinities of Prototheria and Marsupialia ; Adaptive radiation and dentition in mammals .	6 hrs	10
Unit 10	Zoogeography Zoogeographical realms, Plate tectonic and Continental drift theory, Distribution of vertebrates in different realm.	4 hrs	7

PRACTICAL :

Unit No.	Syllabus	Class Hour	Allotted Marks
Unit 1	Study on museum specimens of Protochordata: Herdmania, Branchiostoma, Colonial Urochordata, , Sections of Amphioxus through pharyngeal, intestinal and caudal regions. Permanent slide of Herdmania spicules .	3 hrs	3
Unit 2	Study on museum specimens of Agnatha: Petromyzon, Myxine.	1 hrs	1
Unit 3	Study on museum specimens of Pisces: Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetraodon/ Diodon, Anabas, Flat fish.	5 hrs	4
Unit 4	Study on museum specimens of Amphibia: Ichthyophis/Ureotyphlus, Necturus, Duttapfrynus, Hyla, Alytes, Salamandra.	4 hrs	3
Unit 5	Study on museum specimens of Reptilia: Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus; Identification of poisonous and non-poisonous snakes.	5 hrs	4
Unit 6	Study on museum specimens of Aves: Study of six common birds from different orders. Types of beaks and claws.	4 hrs	3
Unit 7	Study on museum specimens of Mammalia: Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris,	4 hrs	3

	Herpestes, Erinaceous.		
Unit 8	Study of Weberian ossicles of fish, pecten from bird head and brain of fowl.	2 hrs	2
Unit 10	Zoogeography: Study on the vertebrates distributed in different Zoogeographical realms through photographs and videos.	2 hrs	2

Reference Books:

1. Young, J. Z. (2004), The Life of Vertebrates. III Edition, Oxford university press.
2. Parker T.J. and Haswell W.A. (1972), Textbook of Zoology Vertebrates, VII Edition, Volume II
3. Pough H. (2018), Vertebrate life, X Edition, Pearson International.
4. Hall B.K. and Hallgrimsson B. (2008), Strickberger's Evolution, IV Editio,. Jones and Bartlett Publishers Inc.
5. V. K. Agarwal (2016) Zoology for Degree students, S Chand.
6. R.L.Kotpal (2014), Modern textbook of zoology, Vertebrates. (Rastogi Publ., Meerut).
7. E. L. Jordon & P. S. Verma (2009), Chordate Zoology, S Chand.
8. A.J. Marshall (1995), Textbook of zoology, Vertebrates. (The McMillan Press Ltd., UK). (Revised edition of Parker & Haswell, 1961).
9. A.K. Sinha, S. Adhikari & B.B. Ganguly, (1978), Biology of animals. Vol. II. Chordates. (New Central Book Agency, Calcutta).

Additional Information:

a) Suggested Readings:

1. Darlington P.J. (1966). The Geographical Distribution of Animals, R.E. Krieger Pub. Co. · Hall B.K. and Hallgrimsson B. (2008).
2. Strickbergers Evolution. IV Edition. Jones and Bartlett Publishers Inc.

b) Online Tools and Web Resources:

1. <https://www.khanacademy.org/science/biology/crash-course-bio-ecology/crash-coursebiology-science/v/crash-course-biology-123>
2. <https://opentextbc.ca/biology2eopenstax/chapter/chordates/>

Name of the Department: ZOOLOGY
Semester: B.Sc. 2nd Semester
Name of the Paper: Basic concept of applied Fish and Fishery
Paper Code: ZOO-SEC-132
Hours: 30+30=60
Lecture: 2,
Tutorial: Nil,
Practical: 1
Credit: 3 (T-2, P-1)
Full Marks: (50+25) = 75

Course Outcome:

Upon completion of the course, students will be able to –

CO 1: Gather factual and conceptual knowledge on our various fish fauna and fishery industries.

CO 2: Understand, apply and analyse the about the various fish groups, fishing gears, different fisheries and fish farming along with their artificial breeding techniques.

CO 3: Provide conceptual knowledge to aware about the classificatory characters of ornamental fishes of northeast India and to acquire practical skills on the construction and management of freshwater aquarium to start entrepreneurship.

THEORY:

Unit No.	Syllabus	Class Hour	Allotted Marks
1.	Scope of Fish and fishery science.	2	2
2.	Fresh water fish diversity of N.E. India.	3	3
3.	Various fishing gears and crafts used in inland fisheries of NE India.	2	7
4.	Beel fisheries of Assam: Problems and Prospects.	3	6
5.	Freshwater fish farming	10	15
6.	Bundh Breeding & Induced breeding techniques of Indian Major & Minor Carps.	5	7
7.	Construction and management of home aquarium, concept of breeding and culture freshwater ornamental fishes.	5	10

PRACTICAL:

Unit No.	Syllabus	Class Hour	Allotted Marks
1.	Identification of Commercially important food and ornamental fishes of NE India.	3	4
2.	Morphometric and meristic study of fishes.	3	4
3.	Study of fishing gears.	3	3
4.	Demonstration of Induced breeding techniques	6	4
5.	Visit to riverine beel fisheries of Assam.	10	5
6.	Fabrication and management of home aquarium.	5	10

Reference Books:

- Khanna S. S. and H. R. Singh (2014): Textbook of Fish Biology and Fisheries. Narendra Publishing House.
- Jhingran, V. G. (1997): Fish and Fisheries of India. Hindustan Publishing Corporation.
- Laureti, E (2016): Fish and Fishery Products, Daya Publishing House.
